Plan revision number: 0
Plan revision date: June 29, 2023

EMERGENCY AND REMEDIAL RESPONSE PLAN
40 CFR 146.94(a) [LAC 43:XVII:3623.A.1]

Venture Global CCS Cameron, LLC CO_2 Sequestration Project

Facility Information

Facility Name: Venture Global CCS Cameron, LLC CO_2 Sequestration Project

Facility Contact: Fory Musser, Senior Vice President, Development
Venture Global CCS Cameron, LLC
1001 19th Street North, Suite 1500, Arlington, VA 22209
(202) 759-6738, fmusser@ventureglobalIng.com

Well Location: West Cameron Block 5 CS004 Well 001, Cameron Parish, Louisiana
[redacted]

This Emergency and Remedial Response Plan (ERRP) describes actions that Venture Global CCS Cameron, LLC (Venture Global) shall take to address movement of the injection fluid or formation fluid in a manner that may endanger a potential underground source of drinking water (USDW) or nearby infrastructure during the construction, operation, and post-injection site care periods.

If Venture Global obtains evidence that the injected carbon dioxide (CO_2) stream and/or associated pressure front may cause an endangerment to a USDW, Venture Global must perform the following actions:

- Initiate shutdown plan for the injection well.
- Take all steps reasonably necessary to identify and characterize any release.
- Notify the permitting agency (UIC Program Director) of the emergency event within 24 hours.
- Implement applicable portions of the approved ERRP.

Where the phrase "initiate shutdown plan" is used, Venture Global will immediately cease injection and follow the procedure as noted above. Note that in some circumstances, however, Venture Global may need to consult with the UIC Program Director to determine whether gradual cessation of injection (using the parameters set forth in the Summary of Requirements of the Class VI permit) is a more appropriate action. The Director may allow Venture Global to resume injection prior to remediation if Venture Global demonstrates to the Director that the injection operations will not endanger USDW.

1 Local Resources and Infrastructure

The CS004 Well 001 is located [redacted] miles [redacted] of the town of Cameron, Louisiana, approximately [redacted] miles offshore in shallow coastal state waters. The proposed location is approximately [redacted] miles from the nearest freshwater drinking well. The base of the potential USDW in the Area of Review (AoR) is interpreted to be approximately [redacted] feet above the upper confining zone, so there is no predicted influence of the plume on any USDW. The injection well and monitoring wells that are part of this application will have casing set to protect any potential USDW. No above sea level structures are located within the predicted AoR and there is no infrastructure in close proximity to the well site that would be impacted by an emergency. The injection and monitoring well locations and plume extent are shown in the resources and infrastructure image in Figure 1.

[redacted]

2 Potential Risk Scenarios

The following events related to the CS004 Well 001 could potentially result in an emergency response and are outlined in this ERRP:

- Well blowout;
- Injection or monitoring (verification) well integrity failure;
- Injection well monitoring equipment failure (e.g., shut-off valve or pressure gauge, etc.);
- Migration beyond the leased pore space;
- Fluid (e.g., brine) or CO_2 leakage to a USDW;
- A single large release of CO_2 to the surface;
- Low level CO_2 release to the surface;
- A natural disaster (e.g., hurricane, earthquake, tornado, lightning strike);
- Accidents or unplanned events (i.e., typical insurable events);
- Induced or natural seismic event.

[redacted] multiple components of each risk were initially assessed for likelihood (A-rare to E-likely) and severity (1-negligible to 5-catastrophic). The component scores were then tabulated to determine a threat level for each risk from which mitigation measures could be prioritized. A Risk Matrix of this assessment is included in Attachment A. [redacted]

Response actions will depend on the severity of the event(s) triggering an emergency response. "Emergency events" are categorized as shown in Table 1.

Table 1. Degrees of risk for emergency events.

Emergency Condition	Definition
Major emergency	Event poses immediate substantial risk to human health, resources, or infrastructure. Emergency actions involving local authorities (evacuation or isolation of areas) should be initiated.
Serious emergency	Event poses potential serious (or significant) near term risk to human health, resources, or infrastructure if conditions worsen or no response actions taken.
Minor emergency	Event poses no immediate risk to human health, resources, or infrastructure.

[redacted]

3 Emergency Identification and Response Actions

Steps to identify and characterize the event will be dependent on the specific issue identified, and the severity of the event. The potential risk scenarios identified are detailed below.

An internal Venture Global contact protocol and telephone number shall be established so that a lead Venture Global emergency responder can communicate the need for outside assistance to respond to an emergency. Full contact details will be provided to the Director before the start of well construction.

3.1 Well Blowout

3.1.1 Severity

An uncontrolled release from the well after pressure control systems have failed may endanger potential USDWs, health and safety, and the environment. [redacted] Major [redacted] A well blowout [redacted] Such events are rare; however, they could pose a severe risk and danger to those involved in drilling operations, or aboard, or in the immediate vicinity of the wellhead platform.

3.1.2 Timing of event

- During wellbore drilling;
- Subsequent to completion of the well if there is catastrophic damage to the wellhead coupled with failure of the subsurface safety valve.

3.1.3 Avoidance measures

Compliance with established drilling and operational practices that ensure adequate control of the well to include:

- Maintain appropriate mud weights and circulating densities based on offset well data, accepted drilling margins and kick tolerances;
- Perform routine kick and well control drills;
- Adhere to Louisiana Department of Natural Resources (LDNR) and voluntary compliance with Bureau of Safety and Environmental Enforcement (BSEE) requirements for blowout preventer operation and testing;
- Conduct subsurface safety valve testing as per API RP 14b at intervals of no more than 12 months.

3.1.4 Detection methods

- Monitor rate of drilling fluid returns versus rates pumped, pit gains, penetration rates, and pump pressures;
- Gas shows while circulating;

- Change in drill string weight;
- Wet drill string when tripping out of the hole.

3.1.5 Potential response actions

3.1.5.1 Well Control:

- Stop drilling;
- Close blowout preventer (BOP);
- Circulate out kick and/or kill the well as per kill sheet procedure;
- In the event of loss of well control, initiate emergency response communications plan, and notify Venture Global Emergency Operation Center;
- Notify the UIC Program Director within 24 hours of the event, per 40 CFR 146.91(c) and 146.94(b) [LAC 43:XVII:3629].

3.1.5.2 Wellhead failure:

- Cease injecting fluid to the platform;
- Initiate shutdown procedures;
- Initiate emergency response communications plan and notify Venture Global Emergency Operations Center;
- Notify the UIC Program Director within 24 hours of the event, per 40 CFR 146.91(c) and 146.94(b) [LAC 43:XVII:3629].

3.1.6 Response personnel

Personnel who may respond to the emergency event include:

- Onsite drilling personnel and supervisors;
- Well control contractor;
- Venture Global Emergency Response Team and Incident Commander;
- United States Coast Guard, Lake Charles, LA and Port Arthur, TX, Marine Safety Units;
- Other relevant Federal, State and Local agencies. A list of such agencies is included in Section 4 below: Response Personnel and Equipment of this ERRP.

3.1.7 Equipment

Equipment that may be used in an emergency response includes:

- Drilling rig, mud logging equipment, additional pumps, blowout preventers with annular rams, drilling fluid materials to adequately increase mud weight;
- Marine mounted fire suppression equipment;
- Wellhead capping equipment.

3.2 Loss of Mechanical Integrity

Integrity loss of the injection well and/or monitoring well may endanger potential USDWs. This event could occur due to the failure of the cement behind the casing, improperly seated packer, or tubing leak.

Integrity loss may be indicated by the following events:

- Activation of automatic shutdown devices due to:
  - Wellhead pressure exceeding the specified shutdown pressure specified in the permit.
  - Annulus pressure indicating a loss of external or internal well containment.
- A loss of mechanical integrity as identified by mechanical integrity test results.

Pursuant to 40 CFR 146.91(c)(3) [LAC 43:XVII:3629], Venture Global must notify the UIC Program Director within 24 hours of any triggering of a shut-off system (i.e., down-hole or at the service) and/or failure to maintain mechanical integrity.

3.2.1 Severity

A loss of mechanical integrity may be considered a Serious Emergency because it could pose a potential serious (or significant) threat to infrastructure if conditions worsen, or no response actions are taken. Such an event can be controlled by ceasing CO_2 injection and shutting-in the wellhead. Due to the injection well's offshore location and distance of [redacted] miles to the nearest potential USDW, there would likely be minimal immediate risk to potential USDWs used by local residences and industry.

3.2.2 Timing of event

A loss of mechanical integrity would most likely occur during injection and/or post injection of CO_2.

3.2.3 Avoidance measures

Wellbore design and construction and completion to include:

- Hole conditioning, casing centralization and pipe movement associated with well cementing;.
- Placement of corrosion resistant and CO_2 compatible cement blends in the open hole; long string casing annulus with excess coverage into the intermediate casing, long string annulus;
- Cementing casing strings to surface as per 40 CFR 146.86(b)(2) [LAC 43: XVII:3617].
- Installation of CR25 110 API Grade, [redacted] long string casing across the CO_2 injection interval through to above the packer;
- Installation of CR25 110 API Grade [redacted] injection tubing;
- Premier hydraulic-set packer with CO_2 service seal assembly;
- Duplex stainless-steel bridge plugs for zonal isolation and recompletion and corrosion resistant cement for well abandonment.

3.2.4 Detection methods

The integrity and location of cement shall be verified as per 40 CFR 146.86 [LAC 43:XVII:3617] using cement bond log technology to ensure potential USDWs are not endangered via migration of CO_2 via the cement sheath. Use of such technology during drilling and recompletion operations would help identify a poor bond of cement to casing or formation. A poor cement bond could result in a loss of external mechanical integrity via creation of migratory CO_2 leak path(s) in the cement sheath.

Pressure and rate monitoring, pressure fall-off tests, annulus pressure tests, etc., will all be performed according to Module 3 Testing and Monitoring Plan and Module 8 Pre-Operational Testing Program.Such tests help verify both internal and external wellbore integrity and if necessary, appropriate corrective actions associated with a loss of integrity.

3.2.5 Potential response actions

- Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c) and 146.94(b) [LAC 43:XVII:3629].
- Determine the severity of the event, based on the information available, within 24 hours of notification.
- For events in which mechanical integrity has been discovered to have resulted in a Major or Serious Emergency:
  - Initiate shutdown plan to include:
    - Activate Emergency Shutdown Device (ESD) and stop transporting CO_2 from the LNG facilities to the wellhead platform;
    - Close wellhead valve;
    - Close and isolate CO_2 injection manifold;
    - If necessary, vent entrained CO_2 to vent stack.
  - If necessary, close wellhead valve.
  - Monitor well and annulus pressures.
  - Determine the cause and severity of failure to determine if any of the CO_2 stream or formation fluids may have been released into any unauthorized zone.
  - If necessary, pull and replace the tubing or the packer.
  - Install chemical sealant barrier and or attempt cement squeeze to block leaks.
  - Demonstrate mechanical integrity per the methods discussed in Module 3.
  - Notify the Director when injection can be expected to safely resume.
- For events in which mechanical integrity is suspected or not seriously compromised:
  - Conduct assessment to determine whether there has been a loss of mechanical integrity.
  - If there has been a loss of mechanical integrity, initiate shutdown plan.
  - Close wellhead valve.

- Monitor well and annulus pressures.
- Determine the cause and severity of failure to determine if any release of the CO_2 stream or formation fluids may have been released into any unauthorized zone.
- Pull and replace the tubing or the packer.
- Install chemical sealant barrier and or attempt cement squeeze to block leaks.
- Demonstrate mechanical integrity per the methods discussed in Modules 3 and 8 to include casing inspection and annular pressure tests
- Notify the Director when injection can be expected to safely resume.

3.2.6 Response personnel

Personnel who may respond to the emergency event include:

- Drilling manager and/or engineer;
- Onsite Venture Global Company man and/or supervisor;
- Cementing service company;
- Completions engineer;
- Injection operations supervisor/manager;
- Venture Global Emergency Response Team and Incident Commander.

3.2.7 Equipment

Equipment that may be used in an emergency response include**:**

- Drilling rig, logging equipment, BOPs with annular rams, drilling fluid and cementing materials;
- Remedial cementing equipment;
- Workover rig and auxiliary equipment;
- Replacement tubing and or packer.

3.3 Injection Well Monitoring Equipment Failure

The failure of monitoring equipment for wellhead pressure, temperature, and/or annulus pressure may indicate a problem with the injection well that could endanger potential USDWs. Such a failure would likely pose no immediate risk to human health, resources, or infrastructure.

3.3.1 Severity

Injection well monitoring equipment failure would likely be considered a Minor Emergency as it would not pose an immediate threat to personnel and property and can be controlled by replacement of failed components. Due to the injection well's offshore location and distance of approximately [redacted] miles to nearest potential USDW, there is minimal immediate risk to potential USDWs used by local residences and industry as sources of drinking water.

3.3.2 Timing of event

Injection well monitoring equipment failure is likely to occur during collection of baseline monitoring data., during sustained injection or after injection ceases and the CO_2 stabilizes.

3.3.3 Avoidance measures

- Periodic tests of mechanical integrity of the injection well as per Module 3 Testing and Monitoring Plan and Module 8 Pre-Operational Testing Program including:
  - Quarterly, annual, or interval-based well integrity logging for cement evaluation, casing inspection;
  - Continuous measurement of pressure, temperature, mass flowrate of the CO_2 stream, or annular pressure;
- Periodic tests of CO_2 stream composition.
- Regularly maintain equipment to prevent or minimize damage.
- Install damage prevention infrastructure on the platform and place markers to alert the general public of the potential hazards. The markers will include the name of the operator and telephone number.
- Equip the injection well platform with security cameras monitored 24/7.
- An alarm system will trigger in the event of an intentional or unintentional intrusion of the platform area.
- Continuously monitor weather and take precautions during the possibility of an adverse event to limit the potential impact to monitoring equipment.

3.3.4 Detection methods

Quarterly, annual, or interval-based well integrity logging for cement evaluation, casing inspection, and CO_2 chemistry will be used to detect measurements outside of the acceptable uncertainty range as provided by the Testing and Monitoring Plan required by 40 CFR 146.90 [LAC 43:XVII:3625].

Continuously measure and monitor pressure, temperature, mass flowrate of the CO_2 stream, and annular pressure to identify conditions outside of the acceptable uncertainty range as required by 40 CFR 146.88 [LAC 43:XVII:3621].

3.3.5 Potential Response actions

- Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c) and 146.94(b) [LAC43: XVII:3629].
- Determine the severity of the event, based on the information available, within 24 hours of notification.
- For a major or serious equipment failure:
  - Initiate shutdown plan by:

  - Activating the ESD and stop transporting CO_2 from the LNG facilities to the wellhead platform;
  - Closing the wellhead valve;
  - Closing and isolating the CO_2 injection manifold;
  - If necessary, vent entrained CO_2 to vent stack.
- Determine the cause and severity of the failure and initiate repairs.
- Verify integrity loss and determine the cause and extent of failure.
- Limit access to wellhead to authorized personnel only, as necessary.
- Communicate with plant personnel and local authorities to Monitor well pressure, temperature, annulus pressure.
- Demonstrate internal and external mechanical integrity per the methods discussed in the testing and monitoring plan.
- Notify the Director when injection can safely be expected to resume.
- Identify and, if necessary, implement appropriate remedial actions (in consultation with the UIC Program Director) to include repair or replacement of failed components.

- For a minor equipment failure:
  - Conduct assessment to determine whether there has been a loss of mechanical integrity.
  - If there has been a loss of mechanical integrity, initiate shutdown plan.
  - Cease injection immediately.
  - Shut in well (close flow valve). Vent CO_2 from surface facilities.
  - Reset automatic shutdown devices.
  - Monitor well pressure, temperature, annulus pressure.
  - Verify integrity loss and determine the cause and extent of failure.
  - Repair or replace failed components.
  - Identify further remedial actions to correct any loss of integrity.

3.3.6 Response personnel

Personnel who may respond to the emergency event include:

- Operations Manager / Supervisor;
- Operations Engineer;
- Control room supervisor;
- Instrumentation and Electrical Specialists.

3.3.7 Equipment

The type of equipment that will be needed in the event of an emergency and remedial response will vary depending on the triggering event. Response actions (cessation of injection, well shut-in, and evacuation) will generally not require specialized equipment to implement. Where specialized equipment (such as a workover drilling rig or CO_2 resistant cement) is required, the designated Project Manager shall be responsible for its procurement.

3.4 Potential Brine or CO_2 Leakage to an Unauthorized Zone

This event could occur if elevated concentrations of indicator parameter(s) are found in groundwater sample(s) or other evidence of fluid (brine) or CO_2 leakage from the confinement zone.

3.4.1 Severity

Elevated concentrations of indicator parameter(s) in groundwater sample(s) or other evidence of fluid (brine) or CO_2 leakage would likely be considered a Serious Emergency if conditions worsen or no response action is taken. Although the groundwater would be offshore, natural fractures and/or undetected faults could provide a pathway for contamination onshore. This scenario would impact offsite personnel and could require assistance from outside agencies.

While drilling the well, drilling fluid will be in contact with groundwater. This contact is normal for drilling operations. There is virtually no risk of contamination from drilling fluid to groundwater or to a potential USDW that would have impact on water supplies used onshore by local personnel and industry due to the water-based nature of the drilling fluid, quantity of drilling fluid required, depth of invasion of the fluid into the formation, and offshore location of the well.

The more serious risks would arise if the plume reaches faults or fractures that allow CO_2 migration into an unconfining zone or to the surface. Failure of the confining zone could also cause CO_2 to migrate into groundwater.

3.4.2 Timing of event

This event could happen during drilling of the well and during injection of CO_2.

3.4.3 Avoidance measures

Minimum criteria for siting per 40 CFR 146.83 [LAC 43: XVII:3615], and the Area of Review and Corrective Action Plan provided in the Main Narrative and Module 2 per 40 CFR 146.84 [LAC 43:XVII:3615] contain features of the well's bottomhole site selection and subsurface characteristics that help avoid brine or CO_2 leakage into groundwater.

Well construction (per 40 CFR 146.86 and LAC 43:XVII:3617) and completion will also help mitigate possible brine or CO_2 leakage into groundwater or potential USDW. Features of this well design include:

- Coring of confinement and injection intervals to ascertain formation characteristics and lithology;

- Casing setting depths and cementing program as noted above in "Loss of Mechanical Integrity":
- Continuous monitoring of injection intervals and annular pressures.

3.4.4 Detection methods

The CO_2 plume will be monitored as described in Module 3 Testing and Monitoring Plan as per 40 CFR 146.90 and 146.94(b) [LAC43:XVII:3625]. Key detection methods in the plan include:

- Continuous acquisition of subsurface pressure and temperatures via hi-spec downhole gauges to help define and monitor reservoir conditions. Such monitoring will be conducted for both the injection and monitoring wells.
- Indirect monitoring of the CO_2 plume extension via vertical seismic profiling (VSP) in the vicinity around the injection well.
- During the period of sustained injection, scheduled tests and logging will be assessed and compared to those done prior to start of CO_2 injection to confirm that plume migration extent and timing are consistent with predictions.

3.4.5 Potential Response actions

Determine the severity of the event, based on the information available, lower injection rates or stop the injection and notify the UIC Program Director within 24 hours, per 40 CFR 146.91 [LAC 43:XVII:3629].

- Use VSP surveys to assess location and degree of CO_2 movement, as described in the Testing and Monitoring Plan.
- Resume injection, if possible, at a reduced rate.
- Continue monitoring of the plume at a more frequent interval to determine if migration continues.
- If groundwater is affected:
  - Pump CO_2-contaminated groundwater to the surface and aerate it to remove CO_2.
  - Apply "pump and treat" methods to remove trace elements.
  - Drill wells that intersect the accumulations in groundwater and extract carbon dioxide.
  - Provide an alternative water supply if ground water-based public water supplies are contaminated.
- If surface water is impacted:
  - Shallow lakes will quickly release dissolved carbon dioxide back into the atmosphere.
  - Create a hydraulic barrier by increasing the reservoir pressure upstream of the leak.

If the plume continues to migrate out of the zone or beyond the expected plume extent, and if approved by the UIC Program Director, recomplete up hole into the next planned injection interval.

Continue groundwater remediation and monitoring on a frequent basis (frequency to be determined by Venture Global and the UIC Program Director) until unacceptable adverse groundwater impact or threat to a potential USDW has been fully addressed.

3.4.6 Response personnel

Personnel who may respond to the emergency event include:

- Operations Manager / Supervisor;
- Operations Engineer;
- If necessary, Venture Global Emergency Response Team and Incident Commander;
- Specialty environment assessment and remediation contractors.

3.4.7 Equipment

The type of equipment that will be needed in the event of an emergency and remedial response will vary depending on the triggering event. Response actions (cessation of injection, well shut-in, and evacuation) will generally not require specialized equipment to implement. Where specialized equipment (such as downhole pumps and drilling rigs) is required, the designated Project Manager shall be responsible for its procurement.

3.5 Single Large Volume CO_2 Release to the Surface

In addition to circumstances described above related to a well blowout or catastrophic damage to the wellhead and failure of the subsurface safety valve, and those associated with mechanical integrity, this event could occur due to CO_2 migration into unidentified orphan wells, operating equipment over designed pressures, and geological complications.

3.5.1 Severity

A CO_2 release to the surface has the potential for offsite exposure to people and property, or requires the assistance of outside agencies; therefore, based on the duration of the release and proximity of personnel it would likely be considered a Serious Emergency. Note that in most cases, if surface water is impacted, CO_2 will quickly dissolve and not be released into the atmosphere.

3.5.2 Timing of event

Excluding events associated with well blowouts, catastrophic damage to the wellhead and mechanical integrity that have already been described, a CO_2 release to the surface could occur during injection or the post-injection period.

3.5.3 Avoidance measures

- Proper operation and preventive maintenance of all surface equipment and wellhead will be carried out.
- Injection of CO_2 at prescribed rates and pressures.
- Due diligence will be exercised when collecting information from offset wells in the area of review.

3.5.4 Detection methods

In addition to those listed above in the Well Blowout and Mechanical Integrity discussion, detection methods shall include:

- Performing pressure and rate monitoring, pressure fall-off tests, annulus pressure tests, etc. according to the Module 3 Testing and Monitoring Plan.
- Monitor and maintain tubing and annular pressures below the maximum allowed values.
- Regularly maintain and test surface wellhead tree for integrity as per manufacturers guidelines.

3.5.5 Potential Response actions

- Shut-in flowline upon any detection of CO_2 at the surface.
- Initiate shutdown plan by:
  - Activating the ESD and stopping flow of CO_2 from the LNG facilities to the wellhead platform;
  - Closing the wellhead valve;
  - Closing and isolating the CO_2 injection manifold;
  - If necessary, venting entrained CO_2 to the vent stack.
- Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c) and 146.94(b) [LAC 43:XVII:3629].
- Secure and limit access to the area.
- Determine the severity of the event, based on the information available, within 24 hours of notification.
- For all emergencies:
  - Activate downhole safety valve.
  - Close wellhead valve.
  - Evacuate personnel from the facility and begin gas monitoring operations.
  - Allow pressure to bleed off the equipment and process system and allow atmospheric gas levels to return to normal.
  - Determine the cause and severity of the failure to initiate repairs.
  - Demonstrate Mechanical Integrity per the methods discussed in Module 3 Testing and Monitoring Plan.
  - Notify the Director when injection can be expected to safely resume.
- Commence surface clean-up and remediation of effected sites as necessary.

3.6 Response personnel

Personnel who may respond to the emergency event include:

- Operations Manager / Supervisor;
- Operations Engineer;
- If necessary, Venture Global Emergency Response Team and Incident Commander;
- Specialty environment assessment and remediation contractors;
- United States Coast Guard.

3.6.1 Equipment

The type of equipment that will be needed in the event of an emergency and remedial response will vary depending on the triggering event. Response actions (cessation of injection, well shut-in, and evacuation) will generally not require specialized equipment to implement. Where specialized equipment (such as lift boats, barges, intervention tools,) is required, the designated Project Manager shall be responsible for its procurement.

3.7 Migration Beyond the Leased Pore Space

This event could occur if the plume expands beyond what the reservoir model predicts and migrates off controlled acreage into neighboring pore space not controlled by the operator. This event could also occur if the plume expansion causes the plume to migrate into adjacent mineral resources that may affect economic production from that area.

3.7.1 Severity

Should the plume migrate off controlled acreage into neighboring pore space not controlled by Venture Global, such an event would be considered a Minor Emergency.

3.7.2 Timing of event

Migration of the plume off controlled acreage would only potentially occur during injection or after cessation of CO_2 injection.

3.7.3 Avoidance measures

Obtain control of pore space through outright ownership or lease agreements. The pore space lease entered into with the Louisiana State Mineral and Energy Board is estimated to have capacity for more than double the CO_2 the Project anticipates injecting and migration outside the lease area is not anticipated.

Note that there are no hydrocarbon resources producing within the AoR.

3.7.4 Detection methods

The CO_2 plume will be monitored per 40 CFR 146.90 [LAC 43:XVII:3625] and as described in the Module 3 Testing and Monitoring Plan.

3.7.5 Potential Response actions:

- Upon suspicion of plume migration off controlled acreage, lower or stop the injection. Observe plume response.
- Notify the UIC Program Director within 24 hours of confirmation of plume migration off controlled acreage per 40 CFR 146.91(c) and 146.94(b) [LAC 43:XVII:3629].
- Determine the severity of the event, based on the information available, within 24 hours of notification.
- If necessary, initiate the shutdown plan by:
  - Activating the ESD and stopping flow of CO_2 from the LNG facilities to the wellhead platform;
  - Closing the wellhead valve;
  - Closing and isolating the CO_2 injection manifold;
  - If necessary, venting entrained CO_2 to vent stack.
- Use VSP surveys to assess location and degree of CO_2 movement, as described in the Testing and Monitoring Plan.
- Restart the injection, if possible, at a reduced rate.
- Possibly recomplete into a new, shallower injection interval.
- Continue monitoring of the plume at a more frequent interval to determine if migration continues.
- If migration is detected or identified to be likely:
  - Begin negotiations with neighboring landowner to acquire rights to store within adjacent pore spaces.
  - Drill wells that intersect the accumulations in at periphery of controlled pore space and extract carbon dioxide.

3.7.6 Response personnel

Personnel who may respond to the event include:

- Operations Manager / Supervisor;
- Operations Engineer;
- Venture Global Legal and Development Departments;
- Incident Commander.

3.7.7 Equipment

The type of equipment that will be needed in the event of an emergency and remedial response will vary depending on the triggering event. Response actions (cessation of injection, well shut-in, and evacuation) will generally not require specialized equipment to implement. Where specialized equipment is required, the designated Project Manager shall be responsible for its procurement.

3.8 Natural Disaster

Well problems (integrity loss, leakage, or malfunction) may arise as a result of a natural disaster affecting the normal operation of the injection well. Weather-related disasters (e.g., hurricane, tornado or lightning strike) may affect surface facilities. By far, hurricanes and associated storm surges are the greatest natural disaster risk to the well and injection operations.

3.8.1 Severity

A natural disaster such as a hurricane can have a catastrophic impact on personnel and damage to property and have the potential to be Major Emergencies.

3.8.2 Timing of event

A natural disaster can occur during any phase of project development, from well site preparation through site closure. Hurricane season is June through November. The most violent storms tend to be in August and September.

3.8.3 Avoidance measures

There are no measures that a platform can take to avoid hurricanes in this area of the Gulf of Mexico. Certain measures can help mitigate risks of injury to personnel and damage to property, including hurricane stage warnings to all personnel, established procedures for securing platform and evacuation of personnel and platform designed for hurricane wind loadings and storm surges.

3.8.4 Detection methods

The National Oceanic and Atmospheric Administration (NOAA) via the National Hurricane Center uses buoys, ships, satellites, reconnaissance aircraft and Doppler radar to forecast, track, monitor and keep the public informed about approaching hurricanes.

Hurricane warnings and watches are disseminated to the public through television and radio stations, cell phone apps and NOAA weather radio.

3.8.5 Potential Response actions

Testing emergency equipment and communication systems upon entering hurricane season and notice of a storm entering the Gulf of Mexico.

Monitoring the storm progress via the National Weather Service, other public information sources, or private meteorological firms.

If the hurricane could affect normal operation of the injection well, perform the following steps:

- Commence preparations for securing well operations and platform upon notice of Coast Guard Readiness Condition, HURCON 3 (Tropical Storm force winds expected within 48 hours);
- Activate communication with Emergency Operations Center;
- Evacuate non-essential well operations personnel;
- Collaborate with LNG facility personnel, as necessary, as to whether to initiate the shutdown plan by:

- Stopping flow of CO_2 from the LNG facilities to the wellhead platform;
- Activating the subsurface safety valve;
- Closing the wellhead valve;
- Closing and isolating the CO_2 injection manifold. If necessary, vent entrained CO_2 to vent stack.

- Notify the UIC Program Director within 24 hours of the emergency event, as per 40 CFR 146.91 and 146.94(b) [LAC 43:XVII:3629].

Determine the severity of the event, based on the information available and, if possible, within 24 hours of notification.

After the storm passes, conduct an assessment of the well and platform to determine any damage and loss of wellbore mechanical integrity.

3.8.6 Response personnel

Personnel who may respond to the emergency event include:

- Operations Manager / Supervisor;
- Operations Engineer;
- Emergency Response Team and Incident Commander;
- Emergency Operations Center;
- United States Coast Guard.

3.8.7 Equipment

The type of equipment that will be needed in the event of an emergency and remedial response will vary depending on the triggering event. Response actions (cessation of injection, well shut-in, and evacuation) will generally not require specialized equipment to implement. Specialized equipment, (such as rigs and salvage vessels) however, may be required subsequent to assessment of damage to the platform and loss of wellbore mechanical integrity. The designated Project Manager shall be responsible for procurement of this equipment and related services.

3.9 Accidents/Unplanned Events (Typical Insurable Events)

Unforeseen events such as surface infrastructure damage, pipeline leak, compressor failure, boating collision, or other weather-related events may occur while operating CS004 Well 001.

3.9.1 Severity

Unplanned events could result in a Major or Serious Emergencies as they could pose risks to human health, damage to resources and may require assistance of outside agencies.

3.9.2 Timing of event

An unplanned event that results in an emergency can occur at any time subsequent to starting CO_2 injection, through site closure.

3.9.3 Avoidance measures

Equipment will be maintained regularly to prevent or minimize damage.

Damage prevention barriers will be installed at the platform, and markers will be placed to alert the general public of the potential hazards. The markers will include the name of the operator and telephone number.

3.9.4 Detection methods

Detection methods would include routine inspection of the platform, calls to the Emergency Response Team or Emergency Operations Center from private individuals, and notice from the US Coast Guard, Police or Sheriff's Office.

3.9.5 Potential Response actions

- Based on the information available, determine the severity of the event and potential impact to injection operations.
- If the event will impact injection operations or threaten well bore integrity, proceed with the following:
- If necessary, initiate the shutdown plan by:
  - Activating the ESD and stop transporting CO_2 from the LNG facilities to the wellhead platform;
  - If necessary, activating the subsurface safety valve;
  - Closing the wellhead valve;
  - Closing and isolating the CO_2 injection manifold;
  - If necessary, venting entrained CO_2 to vent stack.
- Notify the UIC Program Director within 24 hours of the emergency event, per 40 CFR 146.91(c) and 146.94(b) [LAC 43:XVII:3629].
- Determine the cause and severity of the failure and initiate repairs.
- Demonstrate mechanical integrity per the methods discussed in Module 3 Testing and Monitoring Plan.
- Notify the Director when injection can be expected to safely resume.

3.9.6 Response personnel

Personnel who may respond to the emergency event include:

- Operations Manager / Supervisor;
- Operations Engineer;
- Emergency Response Team and Incident Commander;
- Emergency Operations Center;
- United States Coast Guard.

3.9.7 Equipment

The type of equipment that will be needed in the event of an emergency and remedial response will vary depending on the triggering event. Response actions (cessation of injection, well shut-in, and evacuation) will generally not require specialized equipment to implement. Specialized equipment may be required to remediate damage to the platform and loss of wellbore mechanical integrity. The designated Project Manager shall be responsible for procurement of this equipment and related services.

3.10 Event Description – Modified Surface Topography (subsidence or uplift) Resulting in Property/Infrastructure Damage

This event could occur during injection operations. The injected stream can cause uplift, subsidence, and induce seismic events.

Clastic geochemistry does not support mineral dissolution due to acidic environment. An uplift is not expected to occur due to the depth to the top of gross injection zone; however, chemical compatibility studies are planned to determine whether the injection stream will have any adverse effect on formation fluids and rock properties.

3.10.1 Severity

Given that the maximum extent of the plume is offshore more than [redacted] feet below the seafloor, even if any uplift or subsidence did occur, it would be expected to have little impact on personnel or property. Therefore, this event would be considered a Tier 1 Emergency.

3.10.2 Timing of event

The timing of the event would be well after the start of CO_2 injection.

3.10.3 Avoidance measures

Maintaining injection pressures at predetermined rates that do not exceed 90% of fracture pressure coupled with continuous monitoring of pressures and rates are the principal avoidance measures.

3.10.4 Detection methods

Strain gauges incorporated in the data acquisition system as part of the well completion and as noted in Module 3 Testing and Monitoring plan can help monitor any uplift or subsidence associated with the CO_2 plume growth.

3.10.5 Potential Response actions

- Determine the severity of the event, based on the information available. If necessary, lower the rate or stop injection.
- Notify the UIC Program Director within 24 hours in an emergency event, per 40 CFR 146.91(c) and 146.94(b) [LAC 43:XVII:3629].
- If necessary, initiate the shutdown plan by:
  - Stopping flow of CO_2 from the LNG facilities to the wellhead platform;

  - Closing the wellhead valve;
  - Closing and isolating the CO_2 injection manifold. If necessary, vent entrained CO_2 to vent stack.
- Use vertical seismic profile (VSP) surveys to assess location and degree of CO_2 movement, as described in Module 3 Testing and Monitoring Plan.
- Chemically treat stream to reduce any compatibility issues.
- Notify the UIC Director when injection can be expected to resume.
- Restart the injection, if possible, at a reduced rate.
- Monitor the plume at a more frequent interval to determine if subsidence or uplift continues.
- Demonstrate Mechanical Integrity per the methods discussed in Module 3 Testing and Monitoring Plan.

3.10.6 Response personnel

Personnel who may respond to the emergency event include:

- Operations Manager / Supervisor;
- Operations Engineer;
- Venture Global Development Department;
- Incident Commander.

3.10.7 Equipment

The type of equipment that will be needed in the event of an emergency and remedial response will vary depending on the triggering event. Response actions (cessation of injection, well shut-in, and evacuation) will generally not require specialized equipment to implement. The designated Project Manager shall be responsible for the procurement of any specialty equipment required for response actions.

3.11 Induced or Natural Seismic Event

Based on the project operating conditions, it is highly unlikely that injection operations would ever induce a seismic event inside or outside of the AoR. Based on modelling of reservoir and stress parameter and fault traces for the proposed injection interval, there is no risk of induced seismicity within the AoR.

A detailed discussion of seismic history is included in the site characterization discussion in *Main Narrative*. The region is in a geomechanically stable, low stress domain in an area of low seismic risk. According to the United States Geological Survey (USGS), no seismic events greater than a 2.0 magnitude have been recorded within a ~39 square mile area surrounding the AoR.

Direct and indirect monitoring as per 40 CFR 146.90 [LAC 43:XVII:3625] and as detailed in Module 3 Testing and Monitoring Plan (e.g., plume pressure front monitoring and testing) can help monitor for seismicity.

Based on the periodic analysis of the monitoring data, observed level of seismic activity, and local reporting of felt events, the site will be assigned an operating state. The operating state is determined using threshold criteria which correspond to the site's potential risk and level of seismic activity. The operating state provides operating personnel information about the potential risk of further seismic activity and guides them through a series of response actions.

3.11.1 Potential Response actions

The seismic monitoring system structure is presented in Table 2. The table corresponds to each level of operating state with the threshold conditions and operational response actions.

Table 2 Seismic monitoring system, for seismic events > M1.0 with an epicenter within a 3.5-mile radius of the injection well.

Operating State	Threshold Condition[2,3]	Response Action[4]
Green	Seismic events less than or equal to M1.5 **(1)**	1. Continue normal operation within permitted levels.
Yellow	Five (5) or more seismic events within a 30-day period having a magnitude greater than M1.5 but less than or equal to M2.0 **(1)**	1. Continue normal operation within permitted levels. 2. Within 24 hours of a fifth event, notify the UIC Program Director of the operating status of the well.
Orange	Seismic event greater than M1.5 and local observation or felt report **(1)(2)**	1. Continue normal operation within permitted levels. 2. Within 24 hours of the incident, notify the UIC Program Director of the operating status of the well. 3. Review seismic and operational data. 4. Report findings to the UIC Program Director and issue corrective actions.
	Seismic event greater than M2.0 and no felt report **(1)**	

[2] Specified magnitudes refer to magnitudes determined by the USGS seismic monitoring stations or reported by the USGS National Earthquake Information Center using the national seismic network.

[3] "Felt report" and "local observation and report" refer to events confirmed by local reports of felt ground motion or reported on the USGS "Did You Feel It?" reporting system.

[4] Reporting findings to the UIC Program Director and issuing corrective action will occur within 25 business days (five weeks) of change in operating state.

Operating State	Threshold Condition[2,3]	Response Action[4]
Magenta	Seismic event greater than M2.0 and local observation or felt report **(1)(2)**	1. Determine the severity of the event, based on the information available. If necessary, lower the rate or stop injection. 2. Initiate rate reduction plan. 3. If necessary, vent CO_2 from surface facilities. 4. Within 24 hours of the incident, notify the UIC Program Director of the operating status of the well. 5. Limit access to wellhead to authorized personnel only. 6. Communicate with facility personnel and local authorities to initiate evacuation plans, as necessary. 7. Monitor well pressure, temperature, and annulus pressure to verify well status and determine the cause and extent of any failure; identify and implement appropriate remedial actions (in consultation with the UIC Program Director). 8. Determine if leaks to ground water or surface water occurred. 9. If USDW contamination is detected: a. Notify the UIC Program Director within 24 hours of the determination. b. Follow response protocol as described in "Brine or CO_2 Leak to USDW" and "CO_2 Release to Surface." 10. Review seismic and operational data. 11. Report findings to the UIC Program Director and issue corrective actions.

Red	Seismic event greater than M2.0, and local observation or report, and local report and confirmation of damage **(1)(2)(3)**	1. Determine the severity of the event, based on the information available. If necessary, initiate the shutdown plan. 2. If necessary, vent CO_2 from the surface facilities. 3. Within 24 hours of the incident, notify the UIC Program Director of the operating status of the well. 4. Limit access to wellhead to authorized personnel only. 5. Communicate with facility personnel and local authorities to initiate evacuation plans, as necessary. 6. Monitor well pressure, temperature, and annulus pressure to verify well status and determine the cause and extent of any failure; identify and implement appropriate remedial actions (in consultation with the UIC Program Director). 7. Determine if leaks to ground water or surface water occurred. 8. If USDW contamination is detected: a) Notify the UIC Program Director within 24 hours of the determination. b) Follow response protocol as described in "Brine or CO_2 Leak to USDW" and "CO_2 Release to Surface." 9. Review seismic and operational data. 10. Report findings to the UIC Program Director and issue corrective actions.
	Seismic event >M3.5 (**1**)	

1. Determined by the USGS seismic monitoring stations or reported by the USGS National Earthquake Information Center using the national seismic network.
2. Confirmed by local reports of felt ground motion or reported on the USGS "Did You Feel It?" reporting system.
3. Onset of damage is defined as cosmetic damage to structures – such as bricks dislodged from chimneys and parapet walls, broken windows, and fallen objects from walls, shelves, and cabinets.

3.11.2 Response personnel

Personnel who may respond to the emergency event include:

- Operations Manager / Supervisor
- Operations Engineer
- Emergency Response Team and Incident Commander
- Emergency Operations Center

3.11.3 Equipment

The type of equipment that will be needed in the event of an emergency and remedial response will vary depending on the triggering event. Response actions (cessation of injection, well shut-in, and evacuation) will generally not require specialized equipment to implement. The designated Project Manager shall be responsible for procurement of any specialty equipment required for response actions.

4 Response Personnel and Equipment

The Calcasieu Pass LNG plant ERP Emergency Organization Contacts will be relied upon to implement this ERRP and such contacts will be the same for CP2 LNG. See Attachment B.

A site-specific emergency contact list will be developed and maintained during the life of the project. Venture Global will provide updated site-specific emergency contact lists to the UIC Program Director.

4.1 *Emergency response contacts:*

4.1.1 Off-Site Emergency Organization Contact Details

Table 3: Emergency Services

Agency	Telephone Number
Cameron Parish Fire Department	911 or (337) 775-7511
Cameron Parish Sheriff	911 or (337) 775-5111
Cameron Parish Emergency Medical Services	911 or (337) 542-2926
Cameron Parish Office of Emergency Preparedness	(337) 775-7048
South Cameron Memorial Hospital	911 or (337) 542-4111
Lake Charles Memorial Hospital	911 or (337) 494-3000
Louisiana Emergency Preparedness Office	(225) 925-7500
Louisiana State Police	911 or (337) 491-2511
Louisiana State Police – Hazardous Material Hotline	(877) 925-6595
United States Coast Guard, Marine Safety Unit, Lake Charles, LA	(337) 491-7800
United States Coast Guard, Marine Safety Unit, Port Arthur, TX	(281) 464- 4800

Table 4: Government Agency Notification

Agency	Telephone Number
Environmental Protection Agency Region 6	(214) 665-2200
Class VI Contact	(214) 665-8473
Louisiana Department of Natural Resources	(225) 342-5515
Louisiana Department of Environmental Quality (DEQ)	(225) 219-3640 or (225) 342-1234
Injection Well Incidents	(225) 342-5515
Cameron Parish Local Emergency Planning Committee (LEPC)	(337) 775-7048
National Response Center (NRC)	(800) 424-8802
OSHA – Baton Rouge Office	(225) 298-5458

Equipment that will be needed in the event of an emergency and remedial response will vary, depending on the triggering emergency event. Response actions (cessation of injection, well shut-in, and evacuation) will generally not require specialized equipment to implement. Where specialized equipment (such as a drilling rig or logging equipment) is required, Venture Global or an assigned contractor shall be responsible for its procurement.

5 Emergency Communications Plan

As appropriate, Venture Global will communicate with the public regarding events that require an emergency response, including providing information about the impact of an event on drinking water, the severity of an event, actions taken or planned to respond to an event.

Venture Global will describe what happened, any impacts to the environment or other local resources, how the event was investigated, what responses were taken, and the status of the response. For responses that occur over the long-term (e.g., ongoing cleanups), Venture Global will provide periodic updates on the progress of the response action(s).

Venture Global will also communicate with entities who may need to be informed about or take action in response to the event, including local water systems, CO_2 source(s) and pipeline operators, landowners, and Regional Response Teams (as part of the National Response Team).

Specific emergency communications requirements and reporting protocols associated with injection well operations will be incorporated into the Venture Global LNG Calcasieu Pass LNG Plant ERP and CP2 LNG ERP. These communications shall include Main Control Room Operator and Supervisor contacts, incident reporting and emergency alarm system recognition.

Venture Global will provide local first responders with a copy of this ERRP that includes potential response scenarios.

6 Plan Review

This ERRP shall be reviewed:

- At least once every five (5) years following its approval by the UIC Director;
- Within one (1) year of an AoR reevaluation;
- Following any significant changes to the injection process or the injection facility, or an emergency event; or
- As required by the UIC Director.

If the review indicates that no amendments to the ERRP are necessary, Venture Global will provide the UIC Director with the documentation supporting the "no amendment necessary" determination.

If the review indicates that amendments to the ERRP are necessary, amendments shall be made and submitted to the permitting agency within one year following an event that initiates the ERRP review procedure or as required by the UIC Director.

7 Staff Training and Exercise Procedures

Personnel assigned to the Emergency Response Team and those directly engaged in injection well operations shall be trained to ensure they possess the necessary skills to perform their emergency response duties. In addition to the relevant required training provided by Venture Global, Venture Global has contracted a third-party emergency response firm to provide emergency skills assessment and training of personnel. Such training could include incident response communication drills and shutdown and evacuation simulations. Much of this training will be conducted during on-site and/or table-top training exercises and scheduled drills

ATTACHMENT A

Venture Global CCS Cameron, LLC Emergency Response Plan
Emergency Organization Contacts[5]

ROLE	POSITION	PRIMARY CONTACT INFO	ALTERNATE CONTACT INFO
Incident Commander (IC)	VP Operations	TBD	TBD
Deputy IC (after hours)	Operations Director	TBD	TBD

[5] The specific individuals for these roles have not been identified. This contact list will be updated prior to the start of well construction.

Public Information Officer (PIO)	Public Affairs Manager	TBD	TBD
Liaison Officer (LOFR)	HSSE Director	TBD	TBD
Safety Officer (SOFR)	HSSE Manager	TBD	TBD
Operations Section Chief (OSC)	Operations Director	TBD	TBD
ER Team Branch Director	Designated Fire Chief	TBD	TBD
Security Branch Director	Security Supervisor	TBD	TBD
SLU Branch Director	Shift Supervisor	TBD	TBD
Process Branch Director	Shift Supervisor	TBD	TBD
Power Branch Director	Shift Supervisor	TBD	TBD
Planning Section Chief (PSC)	Site Engineering Director	TBD	TBD
Documentation Unit Leader (DOCL)	Process Engineer	TBD	TBD
Situation Unit Leader (SITL)	Mechanical Engineer	TBD	TBD
Logistics Section Chief (LSC)	Maintenance Director	TBD	TBD
Financial Section Chief (FSC)	Financial Analyst	TBD	TBD
Injection Well Operations	Injection Well Operations Manager	TBD	TBD
Main Control Room	DCS Operator	TBD	TBD
	Supervisor	TBD	TBD

ATTACHMENT B

Risk Assessment

Qualitative Risk Matrix
Definitions (Likelihood)

VENTURE GLOBAL LNG

	Definition
E Likely	This event can reasonably be expected to occur several times during the life of the facility
D Probable	This event can reasonably be expected to occur at least once during the life of the facility
C Possible	This event might occur once during the life of the facility
B Unlikely	This event is not expected to occur during the life of the facility
A Rare	This event has occurred at least once within industry OR is not normally considered a credible event

Qualitative Risk Matrix
Definitions (Severity)

VENTURE GLOBAL LNG

	Health and Safety Impact	Environmental Impact	Reputational Impact *	Project, Asset, & Production Loss *
5 Catastrophic	▪ *Workforce*: Multiple Permanent Total Disabilities or Multiple Fatalities ***OR*** ▪ *Public*: One or More Fatalities	▪ Extensive damage. ▪ Major loss of containment with severe escape to the environment. ▪ A spill or release causing major and sustained pollution external to the site.	▪ Major international impact. ▪ Potential to severely impact future business.	▪ *Project*: >3 months delay ▪ *Operations*: > 30 Days Equivalent Production
4 Severe	▪ *Workforce: Permanent Total Disability or Single Fatality* ***OR*** ▪ *Public: Permanent Partial or Total Disability, or Days Away from Work Case*	▪ Major damage. ▪ Loss of containment with severe escape to the environment. ▪ A spill or release causing significant pollution offsite.	▪ Major national impact. ▪ Numerous complaints. ▪ Extensive negative attention in local media. ▪ National press and TV coverage.	▪ *Project*: 2–3 months delay ▪ *Operations*: > 10 Days Equivalent Production
3 Significant	▪ *Workforce*: Permanent Partial Disability or Days Away from Work Case ***OR*** ▪ *Public*: Medical Treatment or Restricted Work Case	▪ Local damage. ▪ Loss of containment with significant escape to the environment. ▪ A spill or release with the potential to cause moderate onsite pollution and some offsite pollution (but of a limited extent in area/duration) requiring remediation work.	▪ Considerable impact. ▪ Regional public concern. ▪ Numerous complaints received. ▪ Extensive negative attention in local and regional media.	▪ *Project*: 1–2 months delay ▪ *Operations*: > 5 days Equivalent Production
2 Minor	▪ *Workforce*: Medical Treatment or Restricted Work Case ***OR*** ▪ *Public*: First Aid Case	▪ Minor damage. ▪ Loss of containment with minor escape to the environment.	▪ Limited space. ▪ Some local public concern. ▪ Some complaints received. ▪ Slight coverage by media.	▪ *Project*: > 1 week – 1 month delay ▪ *Operations*: > 1 Day Equivalent Production
1 Negligible	▪ *Workforce*: First Aid Case ***AND*** ▪ *Public*: No Impact	▪ No damage to slight damage. ▪ Loss of containment with no escape to the environment.	▪ No impact to slight impact. ▪ Little public awareness of the incident. ▪ There is not public concern. ▪ No media reaction.	▪ *Project*: < 1 week delay ▪ *Operations*: < 1 Day Equivalent Production

** Note: Reputational Impacts and Project, Asset, and Production Loss are not to be correlated to HSE Impacts*